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INTELLIGENT QUALITY MANAGEMENT EXPERT SYSTEM USING PA-AKD IN LARGE DATABASES

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Abstract- Today's, Domain Driven Data Mining (D3M) generally targets Actionable Knowledge Detection (AKD) in complex domain problems of large databases with quality engineering research field. D3M generates the business impacts and solves business problems and the results brunt with the complex context in a kind of artwork. The application of Intelligent Quality Management (IQM) expert system in databases became one of the focuses of this research field. In this seminar, a formal view of AKD from decision making perspectives and an IQM expert system with Post Analysis of Actionable Knowledge Detection (PA-AKD) framework are proposed. With the IQM, it is capable to develop an intelligent decision making system by using PA-AKD framework by integrating and balancing both the technical significance and business expectations of the enterprise. The Intelligent Quality Management system with PA-AKD approach develops the relationships between the enterprise and management processes. The proposed system improves the supportive ability of the enterprise for monitoring the process effective, efficient and adaptable.
Keywords- Intelligent Quality Management, quality control, D3M, PA-AKD.

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Introduction

Artificial intelligence is the branch of computer science that focuses on the development of computer systems to simulate the processes of problem solving and duplicate the functions of human brain. According to Elaine Rich (1983), "Artificial intelligence is the study of how to make computers do things at which, at moment, people are better". This simple, but eloquent, statement captures the essence of the pursuit.

Artificial Intelligence comprises hardware and software systems and techniques that attempt to emulate human mental and physical processes. The mental processes emulated include thinking, reasoning, decision making, data storage and retrieval, problem-solving, and learning. The physical processes include human senses and motor skills. Artificial is also called machine intelligence. Artificial intelligence is a serious pursuit, but most of its components are currently limited to the status of research and theory-based laboratory goals. Expert systems (ES) are a category of programs based on the theory and methods of artificial intelligence. To design an expert system, one needs a knowledge engineer, an individual who studies how human experts make decisions and translates the rules into terms that a computer can understand. An expert system is a narrow slice of computer intelligence and knowledge-based application. Their programs are designed to emulate human decision-making expertise in a particular domain. Expert systems belong to a group of systems known as knowledge-based systems. Knowledge-based systems contain the facts and procedures representing the rule of thumb (heuristic) decision-making processes of an expert. That collection is kept in a knowledge base that is separate from a control program.

Total Quality Management (TQM) is a management approach to

long-term success through customer pleasure. Important aspects of TQM include customer-driven quality, top management leadership and commitment, continuous enhancement, fast response, actions based on facts, employee participation. Once it is recognized that customer pleasure can only be obtained by providing a high-quality product, continuous improvement of the quality of the product is seen as the only way to maintain a high level of customer pleasure. As well as recognizing the link between product quality and customer pleasure, TQM also recognizes that product quality is the result of process quality. As a result, there is a focus on continuous enhancement of the company's processes. This will lead to an enhancement in process quality. In turn this will lead to an enhancement in product quality, and to an increase in customer pleasure. To achieve customer pleasure, the company has to respond rapidly to customer needs. These can be achieved with customer-driven and process-oriented product development because the resulting simplicity and efficiency greatly reduce the time involved.

Product development in a TQM environment is very different to product development in a non-TQM environment. Without a TQM approach, product development is usually carried on in a conflictual atmosphere. Strategic plan must assimilate quality as core component. TQM refers to an assimilated approach by management to focus all functions and levels of an organization on quality and continuous enhancement. TQM organizations assimilate customer knowledge with other information and use the planning process to orchestrate action throughout the organization to manage day to day activities and achieve future goals.

Total Quality Management, or Constant Quality Enhancement, or Strategic Quality Management, or any of the other titles used to describe the principle of constantly striving to improve the products and services. TQM can also be defined from the perspective that is concerned with the performance and the original quality design specification and the quality value gives the clear approach for the quality enhancement. This quality enhancement from the more number of products in database can be increased through the application of post analysis actionable knowledge detection framework. Actionable knowledge mining approach targets the patterns that confirm the relationship about the pattern that satisfies both business expectations as well as technical significance.PA-AKD is a two-step pattern extraction and improvement. From PA-AKD approach of D3M, the refined mined data sets can be extracted from the technical and business intelligence patterns. With the mined dataset products, the quality of each product can be increased with the IQM Expert System. This system improves the supportive ability of the enterprise for monitoring the process effective and adaptable and with the increasing customer requirements and pleasure. Based on the concept of Intelligent Quality Management, it is possible to capture the quality audit data from different processes so as to determine meaningful patterns and knowledge patterns.

Expert System

An expert system is software that uses a knowledge base of human expertise for problem solving, or to clarify uncertainties where normally one or more human experts would need to be consulted for giving best solutions. Expert systems are most common in a specific problem domain, and are a traditional application and/or subfield of artificial intelligence (AI). A wide variety of methods can be used to simulate the performance of the expert; however, common to most or all are: 1) the creation of a knowledge base which uses some knowledge representation structure to capture the knowledge of the Subject Matter Expert (SME); 2) a process of gathering that knowledge from the SME and codifying it according to the structure, which is called knowledge engineering; and 3) once the system is developed, it is placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or as a supplement to some information system. Expert systems may or may not have learning components.

An Expert System is compared with tradition computer

Interface Engine + Knowledge =Expert System

(Algorithm + Data Structures = Program in Traditional Computer)

An expert system is a computer program dedicated to solving problems and giving advice within a specialized area of knowledge. A good system can match the performance of a human specialist. The field of expert systems is the most advanced part of AI, and expert systems are in wide commercial use. Expert systems are examples of micro-world programs: their "worlds"--for example, a model of a ship's hold and the containers that are to be stowed in it--are self-contained and relatively uncomplicated. Uses of expert systems include medical diagnosis, chemical analysis, credit authorization, financial management, corporate planning, document routing in financial institutions, oil and mineral prospecting, genetic engineering, automobile design and manufacture, camera lens design, computer installation design, airline scheduling, cargo placement, and the provision of an automatic customer help service for home computer owners.

The basic components of an expert system are a "knowledge base" or KB and an "inference engine". The information in the KB is obtained by interviewing people who are expert in the area in question. The interviewer, or "knowledge engineer", organises the information elicited from the experts into a collection of rules, typically of "if-then" structure. Rules of this type are called "production rules". The inference engine enables the expert system to draw deductions from the rules in the KB. For example, if the KB contains production rules "if x then y" and "if y then z", the inference engine is able to reduce "if x then z". The expert system might then query its user "is x true in the situation that we are considering?" (e.g. "does the patient have a rash?") and if the answer is affirmative, the system will proceed to infer z.

Types of Expert System

There are many different types of expert systems. The following list describes the various types.

a.Diagnosis: Diagnosis types of expert systems are used to recommend remedies to illnesses, trouble-shoot electronic or mechanical problems or as debugging tools.

b.Repair: Expert systems that define repair strategies are also very common. As well as diagnosing the problem they can suggest a plan for the repair of the item. The repair plan typically contains a scheduling structure and some control structure to validate the repair process. Such systems have been employed in the automotive repair field and similar areas.

c.Instruction: Instructional expert systems have been used for individualised training or instruction in a particular field. The sys-

tem presents material in an order determined by its evaluation of the user's ability and current knowledge and monitor's the progress of the student, altering the sequence depending on this progress.

d.Interpretation: Interpretive expert systems have the ability to analyse data to determine its significance or usefulness. The knowledge base often contains models of real world situations which it compares to its data. These are often used in exploration for mineral, gas and oil deposits as well as in surveillance, image analysis and speech understanding.

e.Prediction: Predictive expert systems are used as a method to "guess" at the possible outcomes of observed situations, usually providing a probability factor. This is used often in weather forecasting.

f.Design and Planning: This allows experts to quickly develop solutions that save time. These systems do not replace experts but act as a tool by performing tasks such as costing, building design, material ordering and magazine design.

g.Monitoring and Control: In certain applications expert systems can be designed to monitor operations and control certain functions. These are particularly useful where speed of decision making is vitally important, for example in the nuclear energy industry, air traffic control and the stock market.

h.Classification/Identification: These systems help to classify the goals in the system by the identification of various features (these can by physical or non-physical) For example various types of animals are classified according to attributes such as habitat, feeding information, color, breeding information, relative size etc. These systems can be used by bird watchers, fishing enthusiasts, animal rescue shelters (to match animals to prospective owners) to name a few.

Actionable Knowledge Detection Database

Actionable Knowledge Detection considers how to take the output of data mining algorithms as input and generate collections of high -quality actions to perform in order to bring out the desired world states, which can be solutions to some complicated business problems. It rather gives collections of actions that can be executed either automatically or semi-automatically, to effect the final outcome of the system. It involves relevantly ubiquitous intelligence surrounding the business problem-solving, such as human intelligence, domain intelligence, network intelligence and organizational/social intelligence, and the meta-synthesis of such ubiquitous intelligence into a human-computer-cooperated closed problem-solving system.

AKD must cater for domain knowledge, environmental factors, technical significance and business expectations from both objective and subjective perspectives, and support automatically converting patterns into deliverables in business-friendly and operable forms such as actions or rules. It is expected that the AKD deliverables will be business-friendly enough for business people to interpret, validate and action, that they can be seamlessly embedded into business processes and systems. If that is the case, data mining has good potential to lead to productivity gain, smarter operation and decision making in business intelligence. Such efforts actually aim at the KDD paradigm shift from traditionally technical interestingness-oriented and data-centered hidden pattern mining toward business use-oriented and domain-driven actionable knowledge detection.

AKD is critical in promoting the productivity of data mining and knowledge detection for smart business operations and decision-making rules. With regard to AKD approach, the existing work mainly focuses on developing post-analysis techniques to filter/ prune rules, reduce redundancy and summarize learned rules. Real world data mining is a complex problem-solving system. From the view of systems and micro economy, the endogenous character of AKD determines that it is an optimization problem with certain objectives under a particular environment [4].

Issues within IQM Expert System

Total Quality Management" system is a kind of quality control system based on the information integration technology, takes combination between quality control and quality management as main principle, and fulfills enterprise's long-term operating strategies finally [2]. Reviewing previous contributions a dominant insight among experts seems to define TQM as an approach to management characterized by some guiding principles or core concepts that embody the way the organization is expected to operate, which, when effectively linked together, will lead to high performance. Although with some differences, there is a general agreement regarding the assumptions included in the TQM concept, which can be summarized in four main points [3].

An effective system for integrating the quality development, quality -maintenance, and quality-enhancement efforts of the various groups in a firm so as to enable marketing, engineering, production, and service at the most economical levels which allow for full customer pleasure-

1.Setting quality standards;
2.Appraising conformance to these standards;
3.Acting when standards are not met;
4.Planning for enhancement in these standards.

The quality chain starts with the identification of all customers' requirements and ends only when the product or service is delivered to the customer, who remains satisfied. Thus, all functional activities, such as marketing, design, purchasing, manufacturing, inspection, shipping, installation and service, etc., are involved in and influence the attainment of quality. Identifying customers' requirements is a fundamental initial point for achieving quality. IQM requires a high degree of effective functional integration among people, machines, and information, stressing a system approach to quality. A clearly defined intelligent quality management expert system is a powerful foundation for TQM.

This seminar attempts to propose an IQM Expert System approval Actionable mining technology and knowledge detection in databases. The basic thought is to assimilate the information of quality control and quality management to primary database, and establish intelligent quality actionable knowledge detection system and quality evaluation decision system.

Expansion of Intelligent Quality Actionable Knowledge Detection System

The quality Actionable Knowledge Detection system in databases is designed to capture the distributed process data from different processes within the assimilated workflow and convert the data into knowledge in terms of AKD method along the workflow, which have positive or negative impacts on the quality of the finished

products. The architecture of the system consists of three main modules namely, data preparation, Actionable knowledge detection and Domain Driven Data Mining as shown in Fig.1

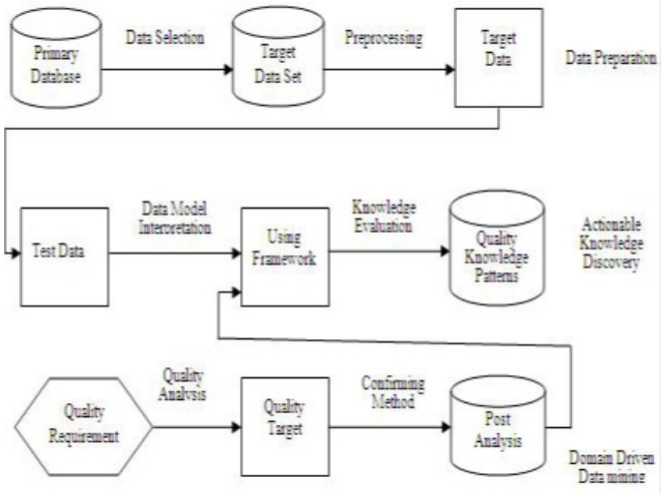

Fig. 1- Architecture of IQM-AKD System

Data preparation module can reduce data dimensions furthermore, enhance valuable quality information and simplify the operation effectively, through eliminating unnecessary or lighter significant attribute. Analyzing data is an important and exciting step in the quality control process. It is the time that you may reveal important facts about your customers, uncover trends that you might not otherwise have known existed, or provide irrefutable facts to support your plans.

By doing in-depth data comparisons, you can begin to identify relationships between various data that will help you understand more about your respondents, and guide you towards better decisions. In the module, there are three main links namely, data selection, preprocessing, data reduction. Data selection is used to collect relevant data from the primary quality database according to the need for quality knowledge detection. The main function of preprocessing is reducing the noise, looking over integrality and consistency of quality data and dispelling the unnecessary data. Data reduction can analyze the initial characteristic attribute of the dataset further after reducing the amount of test data.

The aim of D3M module is just ascertaining the target of quality enhancement. Because different quality targets will adopt different intelligent frameworks during the concrete process of Quality Actionable Knowledge Detection, the model will first confirm the actual types of quality discovered in the process through analysis of quality demanding. After ascertaining quality target, the suitable PA-AKD framework. Then quality mathematics model are set up through corresponding Actionable Knowledge Detection approach.

In order to discover more effective quality knowledge, Actionable Knowledge Detection module might return to the steps of some preceding treatment sometimes, and execute repeatedly. First the relevant quality deliverables can be discovered from the sample data by using the PA-AKD, which can also be expressed by some commonly used expression methods or specific ways. But the in-depth patterns obtained by the above mining algorithm might be "new" or "interesting" one.

It is necessary that the deliverables should also pass through mode explanation and knowledge evaluation. Mode explanation inspects whether the modes according with quality requirement. Knowledge evaluation can present the quality patterns discovered in front of the engineers, check the consistency of quality knowledge, and store the "new deliverables" discovered in the actionable quality knowledge patterns base finally. This module would bring about the enhancement of enterprise quality and monitor the processes continuously by using the PA-AKD.

Architecture of the Intelligent Quality Management Expert System

In the IQM Expert System, the quality information is large-scale and complicated. But the knowledge source of the traditional quality knowledge base mainly comes from the manual summary, which is the experience sum up by relevant experts engaged in quality control. Obviously, the process of Quality Actionable Knowledge Detection, with very strong random city and uncertainty, is too complicated to human brain. Therefore, the conventional quality expert system has "bottleneck problem" of poor quality knowledge'.

How to make decision effectively on the basis of a large number of quality data seems more and more important for quality engineers. Intelligent Quality along with AKD has already become the important tool in quality evaluation and management decision. Through Intelligent Quality Actionable Detection, the quality knowledge patterns base will be established, and it will become the most important component in IQM Expert System [1].

D3M technology well meets the need of quality knowledge acquirement of IQM Expert System. It can discover new quality deliverables from the primary quality database constantly, establishes and enriches the quality knowledge patterns base constantly, offers the new deliverables evidence for IQM expert system.

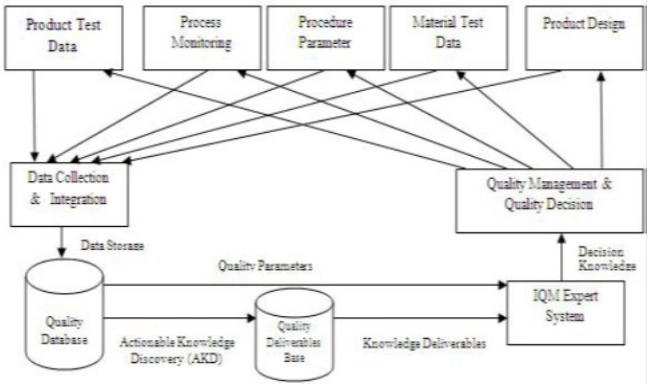

Fig. 2- Intelligent Quality Management Expert System

Conclusion

This seminar presents a system architecture, design for implementing entrepreneur-oriented Intelligent Quality Management expert system and discusses how this approach can be applied to support decision making process in various domains in an organization. In fact, the Domain Driven Data Mining is closely linked to the large potentiality of Business Intelligence with the future of Intelligent Quality Management Expert system. PA-AKD system is then used to extract truly interesting patterns from the database.

By using both technical interestingness and business opportunity patterns of PA-AKD system, the efficiency of accessing the data from their database can be efficiently improved. It will predictably bring Intelligent Quality Management Expert system more extensive application prospect, customer pleasure and market value. The value must make enterprise in different level compete and win totally with now, and play a vital role to the core competitiveness, which strengthen organization.

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